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ANÆSTHETISTS' WORRIES.

IT was recently stated in an Americal journal that there was, at the present time, unrest in anæsthetic matters. The statement is true as regards this country whatever it may be with regard to these affairs on the other side of the Atlantic. It may be not entirely useless to mention the problems which harass anæsthetists in Great Britain just now. They are not scientific only, but also economic and academic. They relate to the multiplicity of methods, with the consequent necessity for innumerable trials and the difficulty of deciding on the best methods for varying conditions; they relate to underpay and overwork, and they relate to the difficulties of giving, at the same time, useful instruction to students and complete satisfaction to surgeons. For the man who is anæsthetist to a large hospital and medical school there is no problem more difficult of solution than the last named. If he uses the latest methods and produces the best possible results from the point of view of the patient and of the surgeon he is of little service to the student working under him; for the methods employed will be those only possible for the expert. If, on the other hand, he devotes himself to teaching the student simple efficient methods which he will find useful in his practice later on, then the teacher is apt to be held by the surgeon to fall short of what is expected of him. The ideal solution of the question would, of course, be that the anæsthetist should train students to be experts and that all anæsthetics in and out of hospitals should be given by experts only. That at present is an ideal which is nearly impossible of realisation, for reasons which are mainly economic but completely dominating. If we

strove only for this ideal and taught only expert methods the result, as things are, would be disastrous for the general practitioner and for the general public. The majority of patients cannot be placed in expert hands. Under the suggested conditions they would be frequently in the hands of the entirely incompetent. It is true, we believe, that surgeons might do more than they do to promote the ideal conditions under which all anæsthetics are given by experts. In the meantime it appears to be the duty of teaching anæsthetists to work on a compromise, and, while giving useful instruction in simple methods to students as much as possible, also to employ wherever it is important to the patient's welfare the best possible method, however elaborate or laborious. It is not enough to do solely either the one thing or the other.

Economic difficulties to which we have alluded are partly due also to the introduction of new methods. These tend to be costly, both in apparatus and in drugs. The extra expenditure in which the anæsthetist is involved should be, but often is not, reflected in an increase in his remuneration.

The question of remuneration, always a difficult one, has been raised lately in the columns of the *Lancet*. Our contemporary, however, was dealing solely with the remuneration of anæsthetists to surgical units in the professorial system in vogue at certain London hospitals. We are sure that all of our readers will have seen with satisfaction the claims that the *Lancet* put forward for a greater and more generous consideration of the needs of these men, and we would like to see that paper urging the need for reform in other directions too, where the remuneration of anæsthetists is concerned.

AN ORIGINAL CLINICAL METHOD OF GIVING CHLOROFORM IN DEFINITE PERCENTAGE DOSAGE.

By S. Thompson Rowling, M.D.

Lecturer in Anæsthetics, University of Leeds; Senior Anæsthetist, General Infirmary at Leeds.

IN view of the elaborate methods of giving chloroform at present being vigorously advocated, it is opportune to publish an original research which has been carried out in the clinical administration of chloroform in definite percentage dosage.

The result of this research is a simple clinical method of obtaining chloroform vapour in definite percentage dosage.

The essential point in the method is the vaporisation of chloroform from a diluted solution.

The degree of dilution determines the percentage of chloroform vaporised.

Any diluent which is inert, neutral, non-volatile and miscible with chloroform without chemical interaction may be used: liquid paraffin is the diluent chosen.

Undiluted chloroform, under similar conditions, gives off 18 per cent of vapour, but when diluted in definite proportions a definite and much smaller percentage is vaporised.

The data are as follows:— The specific gravity of chloroform is 1.497. The specific gravity of liquid paraffin is 0.88— a mixture of the two liquids has an intermediate specific gravity.

A mixture of chloroform 6 drs. with liquid paraffin to 12 oz. has a specific gravity of 0.914 at temperature 70°F. and vaporises 3.5 per cent chloroform. A specific gravity bead 0.914 (red) immersed in the mixture, rises when the proportion of chloroform exceeds this amount and falls when it is less— in other words, when the red bead rises the percentage of chloroform vaporised exceeds 3.5 per cent; when it falls the percentage is less than 3.5 per cent.

Similarly, a mixture containing 5 drs. of chloroform with liquid paraffin to 12 oz. has a specific gravity of 0.908 and vaporises 3 per cent. of chloroform—a specific gravity bead 0.908 (blue) rises when the proportion of chloroform exceeds this amount and falls when it is less—when the blue bead rises the percentage of chloroform vaporised exceeds 3 per cent; when it falls the percentage is less than 3 per cent.

A mixture containing 4 drs. of chloroform has a specific gravity of 0.903 and vaporises 2.5 per cent of chloroform—a specific gravity bead 0.903 (yellow) rises when the percentage of chloroform vaporised exceeds 2.5 per cent and falls when the percentage is less than 2.5 per cent.

A mixture containing 3 drs. of chloroform has a specific gravity 0.897 and vaporises 2 per cent of chloroform—a specific gravity bead 0.897 (green) rises when the percentage of chloroform exceeds 2 per cent and falls when the percentage is less than 2 per cent.

Thus, when all the specific gravity beads are floating the percentage of chloroform being vaporised exceeds 3.5 per cent: when all the beads sink the percentage is less than 2 per cent. When one sinks and three float the percentage is between 3 per cent and 3.5 per cent: when two sink and two float the percentage is between 2.5 per cent and 3 per cent: when three sink and one floats the percentage is between 2 per cent and 2.5 per cent. The position of the beads shows at a glance the percentage of chloroform which is being vaporised.

The chloroform-oil mixture is contained in an ordinary 20-oz glass bottle.

Through the rubber cork are passed one inlet and one outlet tube, and the lower end of a small funnel. The inlet tube reaches to the bottom of the bottle; the outlet tube ends just below the cork.

A short-circuiting tap enables the full strength of vapour to be reduced to any extent, or cut out entirely at any moment.

Chloroform is replenished through the funnel.

A pad of Gamgee tissue beneath the bottle largely prevents the slight noise of bubbling.

When not in use the bottle is surrounded by a coloured cover, to prevent decomposition of chloroform by light.

To prevent any trace of phosgene gas from coming over, pure a-naphthylamine (grs. 10) is added to the mixture.

This mixture method affords a very simple means of obtaining clinically a definite percentage of chloroform vapour on the "plenum" system—much more simple than the methods devised by Dubois, Waller, Collingwood or Alcock. It is accurate for all practical purposes, error ± 0.5 per cent, and foolproof in that it is impossible to give a higher percentage of chloroform vapour than that indicated by the specific gravity beads.

The apparatus consists essentially of a glass bottle and a two-way tap, and the ingredients—chloroform and liquid paraffin—are obtainable everywhere.

Clinical Administration.

The chloroform is vaporised by nitrous oxide, oxygen or carbon dioxide, either alone or in any percentage combination. These gases are obtained from cylinders clamped around the anæsthetic table.

Three dry flowmeters enable the anæsthetist to administer these gases in any percentage combination. The flowmeters are graduated to allow a maximum rate of flow for oxygen 10 litres, for carbon dioxide 5 litres, and for nitrous oxide 25 litres per minute.

The vaporised chloroform from the chloroform-oil mixture is brought over mixed with the vaporising gas or gases. The vapour is delivered by rubber tubing into a Hewitt's gas bag, or directly through the facepiece of an inhaler, or, for little children, to an open anæsthetic mask.

When gas is used the effect of the added chloroform vapour is to intensify its effect. When oxygen is used the chloroform vapour alone produces the effect.

The ideal combination is nitrous oxide, with just sufficient oxygen to prevent cyanosis and a trace of carbon dioxide to stimulate breathing.

The administration begins with the percentage chloroform vapour passed into a closed inhaler, mixed with the vaporising gas or gases. The percentage used is within safe limits, and the vapour is breathed without the least difficulty.

Rebreathing increases the carbon dioxide percentage, which is also increased by any added carbon dioxide, and so respiration is stimulated and the patient loses consciousness rapidly—yet no cyanosis occurs, as there is a constant supply of oxygen with the vaporised chloroform.

During this time chloroform vapour is passing over and anæsthetising the whole respiratory tract, rendering it immune to the irritation of ether.

There is no smell of ether, for the ether is not put into the inhaler until the patient has lost the sense of smell. It is then run into the inhaler just before the time when the ether valve is opened.

The ether valve is now opened and the patient breathes a gradually increasing strength of ether vapour, and, as the first danger period approaches, vaporisation of chloroform is discontinued, oxygen being short circuited into the inhaler.

The anæsthetic effect is now deepened by ether combined with oxygen, and the carbon dioxide percentage increases by rebreathing from the closed bag: increased stimulation results, so that when deep anæsthesia is obtained the patient

has his maximum stimulation, both by ether vapour, oxygen and carbon dioxide. This is the anæsthetic atmosphere during the first danger period of the administration.

After deep narcosis is well established the administration is continued with a very slow stream of oxygen passing through the chloroform vaporiser, and this, mixing with ether vapour in the inhaler, is breathed with a mixture of fresh air, and rebreathed air, the latter to retain the stimulation of carbon dioxide.

The administration is thus continued under ideal conditions—there is oxygen to prevent cyanosis, and carbon dioxide to prevent oxygen apnœa. A very low percentage of vapour combined with a low percentage of ether is sufficient to maintain anæsthesia, and the patient breathes a regulated and amply sufficient supply of fresh air.

The actual administration is preceded by a few kindly words as the anæsthetist takes a mental survey of his patient, noting the general physical condition.

The face is then gently covered with a Gamgee tissue pad, previously sprinkled with eau-de-Cologne, a hole being left in the centre for the nose and mouth.

The patient's eyes are naturally closed by this, and the eau-de-Cologne prepares the way for the chloroform vapour to follow.

The inhaler is now gently applied over the pad: no part of the facepiece touches the skin directly, and as the eyes are covered the patient does not know that an inhaler is being used; and there is only the smell of eau-de-Cologne with a faint, yet gradually increasing, sweet smell of chloroform vapour, which is supplied, mixed with oxygen, at slight positive pressure through the vaporiser.

There is no choking sensation, for there is no ether vapour: no trace of asphyxia, for oxygen is being constantly given with the vaporised chloroform, and the wider bore of the modified Clover's inhaler offers no resistance to free breathing: the bag becomes quietly more and more full, and the supply of oxygen through the vaporised chloroform prevents asphyxia, yet the rebreathing through the bag is sufficient to increase the carbon dioxide percentage in the respired air, and this acts as a respiratory stimulant.

It is surprising how rapidly consciousness is lost under these conditions. A medical specialist said: "In five, or at most six, breaths I was unconscious, without the slightest discomfort." A nurse, who had had nitrous oxide gas a fortnight previously, said that she lost consciousness sooner than with the gas and far more pleasantly. Another patient said: "I am of opinion that I had only breathed six or eight times before I lost consciousness." Another medical man said that the time before he lost consciousness was "about the same as gas, and certainly not so unpleasant," and added that he counted up to 10 and then lost consciousness. Another patient stated that she lost consciousness after five breaths, that there was no choking sensation whatever, and that she would not mind having it again.

Vaporised chloroform has two great advantages over nitrous oxide alone as a preliminary anæsthetic:

1. Chloroform is preparing the way for the subsequent etherisation, by anæsthetising the respiratory tract, rendering it far less susceptible to the pungent vapour of ether, and is, besides, being rapidly absorbed into the blood and tissues, where it will exert an anæsthetic effect during the whole period of the subsequent administration.

2. There is no trace of asphyxia: chloroform is vaporised with oxygen, and oxygen entirely eliminates the element of asphyxia throughout the administration.

Two minutes after the beginning of the administration the ether dome is filled with ether, and the ether valve is opened: shortly after this, as the period of profound narcosis approaches, the chloroform administration is suspended by short-circuiting the oxygen, and the Gamgee facepad is removed. The administration is then continued with ether only until a deep narcosis is obtained.

By changing from chloroform to ether at this period, the first danger period of the administration is passed through with the safe anæsthetic ether: yet the respiratory tract has been so prepared by chloroform vapour that no irritation results. Moreover, the actual transition is not sudden but gradual—the inhaler and the patient's respiratory tract contain the vapours of both chloroform and ether at first, but the

chloroform vapour diminishes and the ether vapour increases in strength as the administration proceeds.

The strongly stimulant ether vapour, with an increased stimulant action of carbon dioxide due to rebreathing into the closed bag, renders the very low percentage of chloroform vapour still present in the inhaler and respiratory tract perfectly safe; yet it is still sufficient to overcome the irritant action of the ether vapour and to render an excessive pushing of ether with consequent excessive dose unnecessary.

And, lastly, pure oxygen is being passed continually into the inhaler, which entirely eliminates all trace of asphyxia.

In this way the first danger period of the administration is amply safeguarded.

When narcosis of the required depth is obtained the maintenance of narcosis needs a very much smaller dose of the anæsthetic. It will be found that anæsthesia may be maintained in most cases by a very slow stream of oxygen—1½ litres per minute—passing through the chloroform vaporiser, the ether valve and air-slot of the modified Clover's inhaler being half way open. Under these conditions a definite and known percentage of chloroform vapour is being delivered very slowly with oxygen into the inhaler, where it is freely diluted. The fresh air is sufficient to ensure a free dilution of the vaporising ether in the ether dome, and the partial rebreathing suffices to maintain the stimulant action of carbon dioxide, and to prevent apnœa in the presence of oxygen.

Summmary.

Vaporised by this method, chloroform acts as the corrective and adjuvant of ether. It gives a rapid induction without discomfort, prevents ether irritation and aids subsequent relaxation.

It is available at any time during the administration and in any percentage dose up to a foolproof limit, and can be cut out instantly.

It is safe because the dosage is known and limited; because its administration is under complete control; because an excessive dose is impossible; because it is administered mixed with oxygen and carbon dioxide, and combined with ether.

These factors render the administration of chloroform by

this method a totally different thing to its administration in irregular unknown percentages on an open mask.

The amount used is small—during the induction period it does not exceed half a dram—and when used during the maintenance period it does not exceed two drams for a long administration.

The fear of delayed chloroform poisoning need not be considered.

During every administration there are two danger periods: initial overdose into the blood; cumulative overdose into the tissues. By changing the anæsthetic atmosphere to ether + O + CO_2 during the first danger period, the danger of chloroform is eliminated, and by giving a minimal percentage of chloroform vapour + ether + O + CO_2, the danger of a cumulative overdose into the tissues is again eliminated.

It is during the early induction period that the vaporised chloroform is of the greatest benefit; it is also available later, if desired, the chief indication being when ether is not taken well: when the patient is rigid, or when the patient is bronchitic and a minimal percentage of ether must be given.

The method has had an exhaustive clinical trial and is found to be simple, efficient and safe.

ETHER CONVULSIONS: A NOTE AS TO TREATMENT.

By Ashley Daly, L.R.C.P., M.R.C.S.
Senior Anæsthetist to the London Hospital.

CASES of convulsions during ether anæsthesia continue to be reported in considerable numbers, and as yet there is no definite knowledge as to their causation, though many theories have been advanced.

The following case is of interest because a method of treatment adopted was immediately successful, and this may throw some light on the cause of the convulsions.

The patient, a female aged seven years, was admitted to hospital in April, 1931, with peritonitis due to perforated appendix. An operation was performed immediately on admission. The peritoneum was drained with two tubes, one through the appendix incision and one supra-pubic.

The appendix was not sought for. She did well, healed up and was discharged from hospital in three weeks.

The anæsthetic used was A.C.E. mixture, followed by open ether, and it was without special feature.

The little girl was re-admitted for appendicectomy on July 29, 1931. She was taken into the theatre for operation on July 30, a very hot day (the theatre temperature being in the region of 80° F.).

The patient was a very fair-haired child, with pink skin and dilated pupils.

Preliminary medication was limited to atropine gr. 1/150.

The anæsthetic used was ethyl-chloride followed by ether on an open mask. It was given by a student under supervision, and a small stream of oxygen was admitted throughout. Induction was quiet and surgical anæsthesia was quickly reached.

The caecum was fixed by adhesions, and considerable difficulty was experienced in mobilising that organ in order to enable the appendix stump to be found. Deep anæsthesia was necessary throughout, but the child's condition was good.

The remaining stump of the appendix was eventually found and removed in the usual way.

Just as the peritoneum was about to be closed, i.e., after about thirty minutes' anæsthesia, clonic convulsions started in the face and jaws and rapidly spread to the rest of the body.

The anæsthetic was at once stopped and $CO_2 + O_2$ were given from a bag through valves, in order to hasten the elimination of ether, but the convulsions continued and the abdomen was closed with difficulty between spasms.

As the child looked hot and her face was flushed and congested the head of the table was raised, with the idea of relieving any congestion of the brain. The convulsions at once ceased and did not recur. The child was returned to bed and the head was kept well up for some hours.

There were no further spasms, and beyond the fact that the pulse next day was 140 and remained above 100 for three days, recovery was uneventful. The patient vomited three times in the night after operation, but not again. Examination of the ether employed showed no impurities to be present.

From this case it would seem that increased cerebral vascularity may play a part in the cause of ether convulsions, and this is borne out in a letter in the *British Medical Journal* (August 22, 1931, p. 358) by Dr. L. T. Clark, of Birmingham. He advances the theory that increased vascularity of the cerebral cortex, particularly of the Rolandic area, is caused by histamine bodies liberated by the trauma of surgical operation and that this effect, being increased by ether, is the cause of the convulsions.

He also draws attention to the fact that convulsions do not occur with chloroform, which tends to cause cerebral anæmia rather than increased vascularity.

A case has also been reported to me where the convulsions were successfully arrested by pressure on the carotid arteries.

If the above theory is correct convulsions should be more common in operations under deep ether in the Trendelenburg position; but in a very large number of these cases no instance of convulsions has been seen.

Whatever may be the cause of the convulsions, their treatment by raising the head is certainly worth a trial.

RESUSCITATION DURING ANÆSTHESIA AND OF THE NEWLY BORN.

By Sir Francis E. Shipway, K.C.V.O., M.D.
Senior Anæsthetist, Guy's Hospital.

(Abstract of a paper read before the Anæsthetic Section, Royal Society of Medicine).

ANÆSTHESIA is not sleep, but a state of unconsciousness brought about by the action of depressing drugs or conditions; at times there must be a danger of paralysis of the respiration and the circulation. The restoration of these vital processes is resuscitation. It must be recognised that there are desperate conditions aggravated by the shock of surgical interference which may be beyond the capacity of the anæsthetist to bring to a successful issue. But whilst this statement can be justified it must be conceded that many deaths are preventable; accidents arise partly from lack of proper knowledge of methods of resuscitation, and partly from delay in their application.

Resuscitation may be defined briefly as the restoration of the nervous and muscular activities of the body. These activities depend largely upon an adequate supply of oxygen and the removal of any excess of carbon dioxide. The exchange of gases may be interrupted in the following ways: (1) Temporary paralysis of the nervous system owing to lack of oxygen or the action of anæsthetics. (2) Paralysis of the muscles of respiration, generally secondary to paralysis of the nervous centres. (3) Failure of the circulation of the blood.

Artificial respiration will supply the needs of the nervous system and reduce the amount of the anæsthetic which is depressing the nervous centres; further, the alternate expansion and contraction of the lungs produce a mechanical effect by pumping the blood, and a respiratory reflex if the medulla

is excitable. This is the Hering-Breuer phenomenon, in which each expiration causes an inspiration.

If the medulla has been paralysed by lack of oxygen or excess of carbon dioxide this phenomenon can no longer be obtained by artificial respiration alone. This is quickly accomplished by artificial respiration combined with the administration of oxygen and of sufficient carbon dioxide to stimulate the centre.

The treatment of respiratory paralysis due to the action of drugs, volatile or non-volatile, which depress the centre is upon similar lines. If respiration has become very shallow oxygen alone is insufficient to supply the needs of the nervous system. As early as 1910 Levi used mixtures of carbon dioxide and oxygen for the purpose of stimulating the centre in cases in which the effects of anæsthetics, of operative shock, or a combination of these causes had temporarily paralysed its activity. He obtained the best results with a mixture containing 15 per cent carbon dioxide.

Henderson and Drinker, at the Centenary Meeting of the British Association for the Advancement of Science, stated that as a result of their wide experience in the resuscitation of newly born children and of persons suffering from carbon monoxide asphyxia a percentage of seven was often found to be effective when one of five had failed. In some cases a percentage of eight or even 10 was needed to stimulate an asphyxiated respiratory centre.

It is clear that for the mixture of five per cent or six per cent carbon dioxide in oxygen commonly used in this country, one containing at least seven per cent strength should be substituted, and a cylinder containing a mixture of this strength should be available in every operating theatre. Carbon dioxide, the natural stimulus of the respiratory centre, is easy to give and is more effective than artificial respiration. Further, it exerts a powerful influence upon the tonus of the skeletal muscles and thus, by augmenting the venous return to the heart, improves the circulation.

Care must be taken when using mixtures stronger than 10 per cent. A percentage of about 30 produces narcosis and death.

The importance of having available a supply of carbon dioxide was shown in my practice during an operation for the removal of tonsils. The patient was elderly and had suffered for many years from a severe degree of myocardial degeneration. During enucleation under ether and oxygen, the airway being completely free, the respiration began rapidly to fail, and the radial pulse could no longer be felt. The head was lowered and the chest squeezed, but the pupils continued to dilate. Carbon dioxide, from the portable sparklet apparatus suggested by Dr. Whitridge Davies, was then given whilst artificial respiration was continued, and almost immediately the breathing returned and the condition improved so rapidly that it was possible to complete the operation. It is highly probable that the prompt use of carbon dioxide will reduce the number of cases in which a fatal result has ensued in spite of what may be described as the more elaborate methods of resuscitation.

In children resuscitation should present no difficulties. Failure of respiration is best treated by lowering the head or partial inversion, and by rhythmical compression of the chest combined with the administration of carbon dioxide and oxygen. In the adult Sylvester's method often fails to restore respiration. It is particularly inadequate in the obese and the elderly, and it is very fatiguing if continued for more than a few minutes. Howard's method is more efficient and less fatiguing.

The prone-posture method of Schäfer produces the fullest ventilation of the lungs, and is the official method of resuscitation from asphyxia due to drowning or other causes in nearly all parts of the world. Unfortunately, it is seldom applicable during an operation, as in the vast majority of cases it entails turning the patient into the prone posture, and imperils asepsis. Moreover, should it fail in restoring respiration and heart-beat, and should some form of cardiac stimulation prove to be necessary, still further delay would arise.

On the other hand, Schäfer's method can be performed by one person, it removes obstruction caused by the relaxed jaw muscles and tongue, and allows free drainage of mucus or fluids which may have gained access to the air passages. Its use, therefore, should be borne in mind in the event of

acute respiratory obstruction arising under anæsthesia and dependent upon the presence of a foreign body. It is hardly necessary to point out that occasions may arise on which laryngotomy or tracheotomy may have to be performed and air forced into the lungs by inflation.

Caution must be exercised against the use of undue violence during the performance of any of these methods of artificial respiration, for many cases of fractured ribs and damage to the internal organs have been reported.

Should the heart cease to beat, attempts to revive it must be made by massage, intracardiac injection of a drug, or puncture of the auricle or ventricle. Massage has been practised for many years. Its function is to stimulate the heart muscle by creating an artificial circulation in the coronary arteries, and to supply the central nervous system with blood. The route which is commonly employed is the subdiaphragmatic, and the heart is either rubbed or kneaded. Many successful cases have been reported. Unfortunately, the majority of attempts at resuscitation by this method are unsuccessful. The route does not give good access, except perhaps in the case of the child, as only the apex is reached, and the heart tends to slip away from the hand in spite of counterpressure by the other hand upon the chest. Bost restored the heart's action, after subdiaphragmatic massage had failed, by incising the diaphragm, passing his hand into the left pleural cavity and grasping and squeezing the heart. Coleman succeeded in producing a response by this method after subdiaphragmatic massage for half an hour had failed to elicit a beat. He states that the heart "could not be grasped or moved at all through the diaphragm because it was small . . . and lying against the back of the chest wall." Norbury was unable to restore cardiac pulsation in thirteen out of a total of sixteen cases of subdiaphragmatic massage deliberately performed. On the other hand, immediate massage when the abdomen was open was quickly followed in several cases by pulsation.

The movements of the hands when the heart is directly grasped are those of compression, and not of massage; they effect two purposes, stimulation of the heart by pressure upon the nerve ganglia at the base, and the emptying of the ven-

tricles, the blood being thereby propelled with more force and efficiency than by the subdiaphragmatic method. In order to prevent pneumothorax the parts are pressed round the wrist. Levy suggests that to prevent this risk whilst artificial respiration is being carried on perflation of the lungs should be carried out, either by intubation or by the passage of an intratracheal catheter, through which a controlled stream of oxygen is passed.

The rate of kneading or of compression should not exceed thirty or forty to the minute, as the heart usually recovers slowly in the case of an overdose, the first beats being feeble; there must be brief intermissions to allow it to recover. The first beats are, as a rule, not only feeble but irregular, and as a regular rhythm may not be established immediately, the heart should be stimulated from time to time until the beats become strong and regular. Most observers are agreed upon the necessity of continuing massage at intervals until the maximal contraction has been obtained. In a case reported by Ogilvie, massage was continued for seventy-five minutes before spontaneous beats could be obtained.

Artificial respiration must be maintained throughout until natural breathing is resumed. Success has occasionally been obtained without artificial respiration, but it is desirable to ensure the circulation of oxygenated blood.

Intracardiac injection of a drug has frequently been practised. A review of the literature reveals the fact that a correct aim is difficult: the right ventricle has often been punctured in an attempt to reach the left. Bodon and others recommend puncture in the fourth left intercostal space, close to the sternal border; the heart is most safely and easily reached by this route.

Many drugs have been used for injection—caffeine, camphor, digitalis, strychnine, strophanthin, adrenalin, pituitrin, metrazol, sodium thiosulphate. Bolton restored pulsation after cardiac arrest under ether by the injection of ether. Imerman revived an elderly patient who was moribund from insulin hypoglycæmia by the injection of a twenty per cent dextrose solution; recovery was immediate.

Adrenalin is the drug advocated strongly by the physiologists. It stimulates the muscles of the heart by its action

upon the sympathetic neuro-muscular junction. Gunn has shown that the mammalian heart, arrested by chloroform, can be restored by perfusion with adrenalin. It produces also a temporary rise in the blood pressure, which assists the recovery of the vaso-motor centre and the heart.

The injection of adrenalin has often been practised by both physicians and surgeons. It would not, however, appear to be without danger. Johnson and Siebert, repeating the work of Fleisher and Loeb, have shown that myocarditis can be produced in rabbits by intravenous injection of adrenalin. Smirnow states that histological examination of the hearts of dogs, given intravenous adrenalin during chloroform anæsthesia, showed marked destructive changes in the bundle of His. Cleghorn and also Crile state that the injection of adrenalin into a cavity or into the muscle may produce fibrillary contractions.

It would seem unwise to inject it when chloroform has been administered, owing to its tendency to cause fibrillation in the presence of this anæsthetic. In making this statement I am aware of the view advanced by Levy that adrenalin is not dangerous in the presence of deep chloroform anæsthesia, but only in the initial stages and during recovery from this anæsthetic. The experience of Jones contradicts this view; there can be no doubt that in his cases anæsthesia was of a depth which Levy has pronounced safe.

Since success has been attained with each of the drugs already mentioned, the question arises whether the result is due to the drug. There must be something more than the action of the drugs, which are numerous and widely different in their actions, which has produced a response from the arrested heart, more particularly as arrest has usually been caused by the depressant action of chloroform and the heart itself has been proved to be the seat of disease. Is it possible that this "something more" is the mechanical stimulation of the needle? Some observers have noted a movement of the needle as it entered the heart. Bodon looks upon this as a good augury of success.

Watson demonstrated in 1887 that in twenty-two out of a total of sixty experiments on dogs killed by chloroform, puncture of the heart alone was sufficient to start the beat.

Hyman, acting upon the view that the success of intracardiac injection depends upon the irritant action of the needle-puncture of the heart rather than upon any specific drug action, succeeded in reviving a patient, who had collapsed during ether anæsthesia, by puncture of the ventricle after all other methods had failed. He states that the arrested heart tends to become irritable, and responds readily to any strong stimulus. The first beats are extrasystoles, which are usually succeeded by normal rhythm, but if the myocardium has suffered much damage during the period of anoxæmia, arrhythmia may persist and develop rapidly into ventricular fibrillation. He suggests that the onset of ventricular fibrillation is the explanation of a secondary collapse after successful resuscitation.

Extrasystoles arising in the auricles followed by auricular fibrillation are compatible with life. Further, the auricles are known to be more sensitive to stimulation than the ventricles. Reasoning upon these lines Hyman punctured the auricle in four cases of patients who had died from various diseases. In two the results were successful, the heart-beat being restored, in one for a period of seventeen minutes after complete standstill for nine minutes, and in the other, a case of mitral stenosis, for a period of eight days. Hyman has now collected forty-four cases in which auricular puncture has been performed. It is carried out by a curved needle inserted in the third right intercostal space, close to the sternum.

Perhaps the most weighty reason for the large number of reported failures in resuscitation generally is delay. Failure does not arise because of inability to restart the heart-beat, although this is sometimes difficult. It is known that the beat may be restored after many hours of cardiac immobility; the heart retains its irritability and excitability for a prolonged period. It was shown many years ago that the heart of a dog could be revived by massage after being placed in snow for as long as eighteen hours. Failure arises because of damage done to the cortical cells through prolonged interference with their oxygen supply. It is more than probable that if the beat has not been restored within five minutes systemic death will almost certainly occur.

Cases of successful resuscitation after periods of apparent standstill of ten, eleven, and even fourteen minutes' duration have been reported. The time of cardiac arrest, however, is difficult to determine with exactitude; the absence of pulse and the impossibility of hearing the heart-beat do not necessarily mean that its action has ceased. Whatever the facts may be, the conclusion is irresistible that the patient must be given the benefit of the doubt, and that unnecessary delay in taking active measures to restore an effective circulation must be avoided, especially if chloroform has been used or the myocardium is known to be degenerated.

Since the restoration of activity of patients moribund from some grave condition such as toxæmia and hæmorrhage seldom meets with a favourable result, there is no object in prolonging attempts in these cases.

In Petty's case of resuscitation after arrest of six and three-quarter minutes, recovery was marked by somnolence lasting twelve hours; in others, consciousness has never been regained, although respiration and circulation were restored for a considerable time. The case reported by Mollison also enforces the lesson of the danger of prolonged interference with the cerebral blood-supply. The patient, a child, recovered after a period of cessation of the heart's action of at least thirteen minutes, and probably longer, but the subsequent history showed that serious damage had been caused to the cortical cells. Mollison states that for some moments after starting cardiac massage "there was no response, then some respiratory movements began and continued intermittently; the boy's colour improved and pupils contracted . . . . still there was no attempt at heart-contraction." He suggests that this attempt at respiration was due to the slight artificial circulation produced, blood being driven to the medulla and stimulating the respiratory centre. This observation of his and a similar observation by Fisher agree with the statement of Gunn that, for the purpose of deciding whether the cells of the central nervous system are capable of complete restoration or not, the time can be calculated, not as from the start of spontaneous heart-beats, but as from the time of beginning massage. It must be remembered in this connexion that massage, to be effective, must drive blood

to the central nervous system. Proof of success in this direction is given by improvement in the colour and by contraction of the pupils.

Primary circulatory arrest due to ventricular fibrillation arises occasionally during light chloroform anæsthesia. This condition is entirely different from that of overdosage; it must be recognised at once, for the treatment is simple and effective if applied at once. The only occasion on which I have seen primary cardiac syncope due to ventricular fibrillation was towards the end of an operation, and as the details of these cases are of value they are given here:

A tall, overgrown youth of eighteen had been under chloroform for about thirty minutes for an operation on his nose; the anæsthesia had been of a medium depth and uneventful, circulation and respiration being satisfactory, although not strong. Towards the end of the operation the concentration of the vapour was diminished and the anæsthetic finally stopped, to prepare the patient for the removal of his tonsils. This case occurred in the days when the opinion was held that such an operation was more safely performed under very light anæsthesia. The first tonsil was removed by the guillotine; at this stage respiration was vigorous and a strong corneal reflex was present. The guillotine was then applied to the second tonsil, but during the course of avulsion the colour, which had been good, suddenly became pale, the pupils dilated widely, and three deep respirations of a gasping character were taken. Respiration then ceased. The sequence of events. namely, sudden cardiac failure, followed rapidly by respiratory failure, was so clear that the condition was recognised. The head was immediately lowered, and the chest squeezed vigorously. The pupils soon became smaller, and recovery was prompt. Jones has reported three cases in which recovery followed very quickly upon inversion.

The outstanding feature in these cases is sudden pallor. Death is obviously not preceded by respiratory failure. The heart has failed not because it is overdosed. but because fibrillation has been produced. There is a spontaneous tendency for it to recover, but it is advisable not to wait too long for this to occur, for if the heart has become asphyxiated it can then be revived only by direct massage.

The nervous system and heart of a child apparently still-born are more resistant to lack of oxygen and excess of carbon dioxide than is the case in the adult. Its lungs resemble a solid organ, and require inflating with air. The first essential before endeavouring to resuscitate a child suffering from asphyxia neonatorum, therefore, is to clear the air passages of fluid; pulmonary respiration can then usually be established. Fluid is best removed by means of posture or by suction. Mouth-to-mouth inflation supplies sufficient oxygen and carbon dioxide if it is successful in filling the lungs with air, but it is more likely to inflate the stomach. Its use should be reserved for emergencies. Following the clearing of the air passages the treatment differs according to the type of asphyxia from which the child is suffering. If blue asphyxia is present resuscitation should be easy owing to the vigour of the circulation. As warmth increases the metabolism and excitability of the nervous system, the child should be placed in a warm bath and time given to it to start spontaneous breathing. Should this be delayed cutaneous stimulation by cold water may be practised. It is erroneous to suppose that stimulation of the skin by douching is all-important; whether the child is born in arctic or tropical regions the tendency is towards spontaneous respiration. If douching fails, or if the heart-beat becomes feeble, artificial respiration by the method of Schäfer should be started.

In the case of a child suffering from white asphyxia the circulation is failing. The hold upon life of such an infant is feeble, and extreme gentleness in handling is essential. Warmth is even more important than in the case of the blue child; gentle artificial respiration and, if it is available, the administration of a mixture of oxygen and carbon dioxide may meet with a favourable response. If these fail in establishing respiration and the pulse becomes more feeble direct stimulation of the heart by auricular puncture should be attempted.

In some cases white asphyxia is dependent not upon an injury and interference with the placental circulation during a difficult labour, but upon absorption from the mother's blood of a drug which has been used to diminish the pains of childbirth. Morphia and hyoscine are often used to induce the

condition known as twilight sleep; chloroform, also, is given frequently for a prolonged period during labour. These drugs depress the respiratory centre both of the mother and of the child, with the undeniable result that the lives of some infants are endangered, for the resuscitation of a child born under these conditions may tax to the full the resources of the practitioner and his assistant, at a time when the demands of the mother upon their services may be imperative. To meet this emergency a mixture of oxygen and carbon dioxide should always be carried, or Davies's portable carbon dioxide apparatus.

To sum up: there are many causes of respiratory and circulatory paralysis. In general, the use of carbon dioxide and oxygen both for their prevention and, combined with artificial respiration, for their treatment is to be encouraged. Partial inversion is of use in the absence of asphyxia; it should be adopted at once for the treatment of primary circulatory syncope. If the action of the heart cannot be restored by these means, puncture of the auricle followed, if necessary, by direct massage should be performed. If the abdomen is already open subdiaphragmatic massage may be carried out; if not successful within two minutes direct massage must be undertaken. Artificial respiration must be maintained throughout until natural breathing is restored.

The time-factor is all-important. Circulation must be restored within five minutes of the time of arrest.

During all attempts at resuscitation the body-temperature of the patient must be maintained.

CASUAL COMMENTS.

A CORRESPONDENT, who does not wish his letter published, has written to the Editor of this journal expressing his regret that we do not "encourage correspondence." There is nothing further from our intentions than the discouragement of anyone who feels disposed to write to us on any subject connected with anæsthetics, but how are we to encourage him to do so? We have published letters whenever we have received them. We would gladly go out of our way to broach subjects which are likely to evoke correspondence. The comparative lack of correspondence cannot, we feel, be laid justly at our doors. It is the fault of the correspondents if they do not correspond. Our pages will be open to them, our space is theirs to fill, whether we agree with what they write or not. So anxious, indeed, are we to receive their contributions that we are herewith starting what the daily papers would probably call a new feature. We are putting a new heading over pages which are to be given up to sundry topics of interest to anæsthetists as they arise, and here in these Casual Comments we hope that we may be more likely to "encourage correspondence" than we appear to have been in set articles. Perhaps, by touching on a wider range of topics, we may have a better chance of arousing the approbation, or the disapprobation, of correspondents to such a degree that their warmth may burst into the flame of letters and, indeed, encourage them to correspond. They may rest assured that their criticisms will be published by us as willingly as their commendation, and we shall be gratified by the receipt of either. If we can stimulate them to write something which their fellow readers will be interested to see we shall feel satisfied of having fulfilled our task, whether what we receive is a measure of praise or of blame.

Nations are said to get the laws that they deserve, and, similarly, it may be said with some truth that the readers of papers, and even of journals like ours, get the articles which they deserve. If a publication is unsatisfactory it is not just

merely to blame those who are directly responsible for its publication. There is a mutual dependence. The reading public reacts on those who write for it. Where journals like our own are concerned the interdependence of writers and readers is even more complete. Our readers are of necessity also to some extent our writers. We are only anxious that they should become so to a greater extent in the future than they have been in the past, and we hope with all our hearts that they will take what we have said not merely as an encouragement to correspond, but as an invitation to send us, besides letters, articles of still more formidable calibre.

Outside London.

There must be plenty of scope for articles from various centres in Great Britain which would be of great interest and advantage to readers who live and work in other places. Even in London there is a good deal of difference, for example, in the routine conduct of anæsthesia at different big hospitals. Probably the difference is just as marked, or more so, between different great provincial teaching hospitals. It would be interesting to hear what are the most generally used methods in Edinburgh, in Bristol, in Belfast, in Leeds, to mention only a few great centres. Perhaps, when these lines are read by subscribers to the journal who work in the places mentioned, or others like them, they will be moved to send us accounts of the methods usually employed in the school to which they are attached. Information, too, as to the arrangements for teaching students at all these different centres would certainly be valuable. It is impossible, nowadays, for a man to see much of the work at hospitals other than those for which he himself works. At least it should be possible for him to read about the way in which anæsthetics and the teaching of them are carried out elsewhere. There would be much valuable information for many people if we could publish a series of articles of the kind suggested. And there is no reason why we should not do so—except that hitherto not many enough of our readers sent the requisite articles. However, now that our desires are plainly stated we shall, no doubt, be better off in the future.

Anæsthetics and Statistics.

Probably most of our readers noticed a letter which appeared in the *British Medical Journal* of November 28, last, over the signature of F. L. Hoffman. The writer contrasted the figures representing death rates per 100,000 of population in a series of years for England and Wales, and for the United States of America. The fatalities were supposedly those "under or associated with anæsthesia," and the figures showed, for the last recorded year, 1929, a rate of 1.84 in Great Britain as against 0.52 in America. Naturally, the letter was soon followed by answers, from Howard Jones and others, pointing out the reasons why figures of this kind have no real value. In the first place it was observed that the death rate per 100,000 of population need be no true representation of the death rate per 100,000 administrations of anæsthetics; that we know nothing of the comparative stringency of the registration demands in the different countries nor of what the probabilities are of fatalities going unrecorded. Nevertheless, one or two correspondents put forward reasons why they would expect results to be better in America than here. These related chiefly to the fact that in America a greater number of operations are carried out in hospitals as opposed to private houses and nursing homes, and that arrangements generally and anæsthetic apparatus are superior in hospital to those outside. Apropos of this statement, however, it was interesting to note that another correspondent suggested that anæsthetic fatalities, nowadays, are perhaps to be attributed to the complicated nature of the apparatus employed. Putting aside all question of comparison between different countries, there seems good ground for the unpleasant suspicion that the death rate for anæsthesia has risen within recent years in Great Britain. It may be that the rise, as represented in the Registrar General's figures, is merely due to improved and more conscientious registration. On the other hand, it may be true that the number of deaths has gone up, not merely because the number of operations has gone up, but out of proportion to this rise, and we notice that this opinion is held by T. Layton, whose book we review on page 96. He states, as a surgeon, that in his opinion the anæsthetic deaths are the most important surgical problem of the moment. This

is a formidable statement, particularly as its author does not attribute the facts which he deplores to anæsthetists any more than to surgeons.

An inquiry into these fatalities was held some time ago, for the purposes of which statistics with regard to no less than 800,000 administrations in hospitals were collected. So far as these institutions were concerned it was shown that the death rate had not risen out of proportion to the rise in number of operations, and the deduction was drawn that if there had really been such a rise in the country at large the increased fatality must be placed in private houses, cottage hospitals, and nursing homes.

Statistics, however, are extremely untrustworthy guides in this matter, and one would be unwise to form a settled opinion even on those which depend on a very large number of figures. The most important fact to bear in mind appears to us to be that which was deduced long ago by a British Medical Association inquiry, viz. that the most determining factor in the safety of anæsthetics was the experience and skill of the administrator.

ALLONAL AND AERIS.

By H. Bellamy Gardner.

ON May 23rd, 1931, I ventured to suggest a new name for nitrous oxide gas on account of the unpleasant sound of the generic term "gas" by which it is generally known and offered to our patients. My letter was published in the *Lancet* on that date, and by now there has been sufficient time for both the medical and dental professions to consider the matter and, I hope, adopt it for future permanent use. The new word is "aeris," suggesting that its components are those of air and, perhaps by its sound, conveying an attractive and refreshing breeze.

For a long time it has been recognized that if only a trace of some other and perhaps less volatile anæsthetic be introduced with nitrous oxide and oxygen a greater relaxation and tranquillity can be obtained during the operation; but in my experience neither ethyl-chloride nor ether could be used without producing heaviness or nausea and headache in many cases, and, in fact, directly the administrator passed beyond the well-recognised limits of nitrous oxide and oxygen the patient's ability to resume his daily occupation was menaced by after-effects.

We had always wanted a "little something" extra in certain difficult cases, and at last I believe we have found it in the form of tablets of allonal (Roche)—one of these taken at bed-time the night before the operation and another three-quarters of an hour previous to the appointment ensures a good night's rest and a cheerful outlook for the day, followed by a definite obtunding of apprehension and a quieter anæsthesia when the time arrives. Alcoholics require a heavier dose of three or four tablets, according to their size and weight. This very rapidly eliminated substance owes its hypnotic quality to allyl-isopropyl-barbituric acid, and is of such low toxicity that doses of 25, 28, and even 50 tablets have not proved fatal.

I have used it very largely for the past two years and

experimented upon myself with it, and can recommend it with a staunch conviction of its value.

The curious absence of nausea after its exhibition is very distinct, and this may be due to the sedative effect before the anæsthetic, for I have no doubt that apprehension and reaction are potent factors in producing nausea.

Illustrative case. Mrs. W., aged 45, requiring several difficult extractions, admitted extreme nervous fear and apprehension of nausea from nitrous oxide and oxygen. At her first sitting, when three teeth were removed in four minutes, for which I administered this anæsthetic by the nasal method, very persistent sickness and depression followed. A week later, after the above prescribed administration of allonal, she came again, presenting a cheerful demeanour, without apprehension and remaining a good colour during the administration for a similar number of teeth, awoke without a trace of sickness and was able to leave, unassisted, within ten minutes of its completion.

The difference was so marked that she has become as firm an advocate of the value of allonal as I am myself.

As a hypnotic I have found it ensures an excellent sleep of seven or eight hours' duration unless the patient has marked indigestion beforehand.

I have found children to be very sensitive to allonal, and suggest that half a tablet at night and half a tablet before the operation for dental extractions will be found sufficient until the age of twelve years when, unless they be unduly small, a tablet may be used, as for adults.

This preparatory dose has not occasioned enough hypnosis to prevent any patient from travelling to the dentist in an ordinary manner; but I always warn patients not to drive themselves in a car on these occasions, and this should be insisted upon in every case.

There are quite enough difficulties in London traffic without introducing the slightly erratic driver who has just taken aeris, to the perplexity of the ensuing motorists on the road behind him.

In my personal experiments of the taking of allonal there follows no heavy drowsiness nor confusion of ideas such as that produced by morphia, but an excellent clarity and

freshness; and though I have taken one tablet at bed-time regularly for thirty consecutive nights I have never experienced any ill effect, but only many hours of peaceful sleep.

It has been just sufficient to prevent disturbance by the late arrival of taxi-cabs and other traffic noises of the night, but not enough to cause any difficulty in being aroused or disability in answering a call on the telephone.

I am firmly of opinion that we have found exactly what has been required to assist us very materially in the exhibition of this anæsthetic, namely aeris, for dental operations.

SOME NEW CLINICAL WORK ON CHLOROFORM.

DR. HORNABROOK, of Melbourne, whose advocacy of chloroform and ether is well known, has forwarded to us the details of a number of cases showing what can be done with these agents if they are employed with the proper technique.

This comprises the use of small doses of morphia and atropine beforehand, extreme care in shielding all the patient's senses from disturbance during induction, which is a very gradual process, and more limitation of the amounts of anæsthetic administered.

Dr. Hornabrook always begins induction with a weak chloroform vapour, changing early to open ether. He certainly manages to get good results with remarkably small expenditure of ether and chloroform, e.g. ether three ounces five drams and chloroform four drams for a laparotomy of sixty-five minutes.

Dr. Hornabrook has had carried out on himself some experiments to show by means of the electro-cardiograph the action of chloroform on the heart in the early stages of inhalation. With regard to this, Professor W. A. Osborne writes that the "electro-cardiograms obtained during the period when the circulation was faulty opened up a new chapter, it appears to me, in the pharmacology of chloroform. Hitherto, in dealing with the effects of this agent on the heart, we have turned our attention chiefly to the direct poisoning action on the myocardium. When vagal excitement is thought of it is invariably in terms of chronotropic change. In Dr. Hornabrook's case the main cardiac disturbance was the change of site of origin of the systole from the normal sino-auricular node to the antero-ventricular node. This means that the ventricular systole in both chambers was not preceded by an auricular systole . . . Robbed of this preparatory action the ventricular output is reduced, and there is no compensatory quickening, but the reverse—a very obvious

slowing. The sudden onset of the disturbance, and its quick relief, both of which I witnessed, would tend to the view that this nodal rhythm was of vagal origin. This is, I think, an entirely new idea, and and surely a very important fact in the study of chloroform anæsthesia. If the shifting of the site of origin of systole from the normal position is due to vagal action then we are justified in assuming that this disturbance will be prevented by previous administration of atropine."

Dr. Hornabrook's own conclusions from his experiments were that chloroform should not be administered to a tired patient, and that the small preliminary dose of atropine and morphia is a decided factor in lessening risk.

ABSTRACTS.

Prevention of post-operative thrombosis and embolism. Norsk Mag. f. Leegird. September, 1930.

THE authors maintain that post-operative complications can be made less frequent by giving large amounts of water, both before and after operation. On the day before operation three litres are given. After operation an enema of one litre with two tablespoonfuls of brandy is given. After this a drop enema of 0.9 per cent salt solution with 50 grms. dextrose is given up to two litres. This is continued to the extent of at least one litre daily for the next two days. In acute abdominal cases a litre of this solution is given intravenously before the patient leaves the operating table. In all patients over twenty years of age the foot of the bed is elevated for a week after operation.

The abolition of pain in normal childbirth. Prof. J. FRIGYESI in *Schmerz-Narkose-Anæs.*, June, 1931.

THE author considers in detail the great number of different methods, including those of local anæsthetics. He decides in favour of the combination of pernocton with small doses of scopolamine or with local analgesia. For the general practitioner he recommends Sellheim's scopan with a mixture, given by the mouth, of omnopon and scopolamine in cognac and syrup. This should be given, he says, in two doses, one three to four hours and the other one and a half hours before the culmination of labour.

In the same journal a subsequent writer describes the use of pernocton as resulting too often "through the excitement it produces, in a struggle between the intern helpers and the woman in labour." For this reason he has given up its use. It is only fair to Frigyesi, however, to note that this criticism may not apply to the combined use of pernocton and scopolamine. Wachtel recommends a mixture like Sellheim's but with omnopon replaced by dilandid.

For the management of pain and sleeplessness after operations, without the use of morphia, P. Röttger uses allonal, per rectum. This preparation contains a hypnotic (allylisopropylbarbiturate) together with an analgesic (dirnallylamino-antipirin). Two tabloids in five c.c. of water are given per rectum as soon as the patient complains of pain. Three more tabloids are given at night and on the second day, if necessary, a further three. The first 48 post-operative hours are thus passed in a kind of doze. The fœtus is passed during this period and the absence of pain greatly spares the patient's strength.

Pfleiderer (*Schmerz-Narkose-Anæsthesia*, August, 1931), reports an explosion during the administration of chloroform, ether, and oxygen from a Roth-Dräger apparatus. The cause of the explosion was not discoverable. The apparatus was one that had been in use, without harm, for 20 years. The patient's face was damaged and her breathing temporarily depressed. She, recovered after considerable swelling and surgical emphysema of the face and neck.

Amytal for children. MARY BOTSFORD in *Anæsthesia and Analgesia* September, 1931.

THE author writes on an experience of fifty cases, the patients being from two to 14 years of age. The drug was given by the mouth, the dose being from one and a half grams at two years to nine grams at 14 years. The conclusions arrived at were that amytal can be given with safety to children from two years of age upwards, that it is more effective than opium in preventing fear and that administration by the mouth gave the best results. No other preliminary hypnotic was given, and nitrous oxide and oxygen sufficed for most operations; ether being used also for the tonsillectomies.

In the same Journal (p. 236) occurs the interesting pronouncement: "Research just completed indicates the basic phenomenon true of all known types of narcosis or anæsthesia. This is reversible coagulation of the cell colloids."

The use of eserine for regulating general anæsthesia. GARRELON in *Presse Medicale*, October 8, 1930.

IT is claimed that the injection of 0.5 mgr. of physo-stigmine salicylate into patients who are lightly under the influence of ether or chloroform has remarkably valuable results. The patients become fully anæsthetized with well-relaxed abdominal walls although they may continue to talk, and recover promptly when the anæsthetic is withdrawn.

Avertin in surgical anæsthesia. F. B. GURD and WESLEY BOURNE *in Can. Med. Assoc. Journ.*

FROM a careful study of 70 cases, including 24 laparotomies, of which 10 were in the upper abdomen, the authors report that the continued anæsthesia induced by rectal administration of small doses of avertin (they never exceed 0.1 gr. per kilo), relatively small doses of novocain and very small doses of nitrous oxide (rarely with the employment of ether) is the most pleasant that they have employed, that operations under these conditions are associated with less shock than by other methods, and that there is a greater freedom from disturbing phenomena. The anæsthesia is not associated with increased bleeding and is accompanied by complete relaxation and

absence of straining on the part of the patient. The authors believe in slow instillation of the avertin, taking at least 10 minutes. They hold that administration of adrenalin may produce serious cardiac irregularity during avertin narcosis and that ephedrine will interrupt or considerably shorten this form of anæsthesia.

Carbon dioxide and oxygen mixtures. Anæsthesia and Anal., Nov. and December, 1931.

INVESTIGATIONS were carried out to determine the stability of mixtures of the two gases, so that it could be known if the mixtures in common use, say five per cent to 25 per cent CO_2 in oxygen, might be safely transported in cylinders. The authors concluded that mixtures containing up to 30 per cent CO_2 are perfectly safe, and will not stratify at temperatures prevailing in U.S.A.

Premedication values of several barbituric acid derivatives and avertin in relation to nitrous oxide anæsthesia. Anæsthesia and Analgesia, November and December, 1931.

AN experimental investigation carried out on rats placed a number of drugs as regards order of toxicity, in the following order, from high to low :—

Pernocton, barbital, luminal, amytal, phanodorn, reonal, allonal, dial, avertin, and pentobarbital.

As regards hypnotic efficiency, judged by the lowest percentage of lethal dose required to produce complete hypnosis they were arranged :—

Pentobarbital, dial, allonal, reonal, avertin, phanodorn, pernocton, amytal, luminal and barbital;

And as regards premedication efficiency, judged by the ratio of effective to lethal dose, the minimal duration of hypnosis to complete recovery, with fewest disagreeable side-actions, they came out :—

Pentobarbital, avertin, dial, allonal, reonal, phanodorn, amytal, luminal, barbital and pernocton.

SECTION OF ANÆSTHETICS.

(Royal Society of Medicine).

At the first meeting of the Association on November 9th, Mr. G. Ramsey Phillips, president, in the Chair, Dr. H. W. Featherstone read a paper on "Anæsthesia for diathermy and endoscopy."

He showed how the increased use of diathermy and electrical illumination for investigating internal structures of the body had multiplied the occasions on which ignition of inflammable anæsthetic vapours was easily possible. Ethylene and oxygen should never be employed where an electrical spark or an open flame were likely to be present. Air and ether will explode when the proportion of ether present is between two per cent and about 48 per cent. Ether and oxygen in nearly all proportions above two per cent of ether explode violently if ignited. The mixture of ether and air exhaled from the lungs of patients deeply under ether was found, in repeated experiments, to be non-inflammable. Neither chloroform not nitrous oxide will ignite even when mixed with oxygen, but chloroform is decomposed with the formation of phosgene and other irritating products.

Provided a patient under ether takes a few deep breaths of air after the ether is stopped, anæsthesia may be maintained with chloroform or with nitrous oxide without risk of explosion, even if a spark or a hot instrument be present within the mouth. Care is needed, however, to be sure that no inflammable mixture of air and ether swallowed into the stomach is regurgitated during diathermy of the upper air passages.

J. D. Morgan, Esq., D.Sc, showed some excellent experiments illustrating the inflammability of ether air mixtures, and the dissimilar effects of differently sized sparks in identical mixtures. He did not illustrate the ignition of an ether-oxygen mixture, because the detonation is shattering, and would have blown his jar to pieces. He said that most vapours only supported combustion when used with air or oxygen in proportions lying between certain limits. In mixtures outside the limits a flame will not spread. Such mixtures may be ignited but the flame will, sooner or later, be extinguished without travelling through any considerable volume of the mixture.

If a mixture of maximum inflammability is ignited in a glass tube the flame moves rapidly through the whole of the tube. A richer or weaker mixture burns less rapidly, but the flame will not be extinguished before passing through the whole tube. A mixture outside the limits may be ignited, but the flame will not travel far from the source of ignition. A mixture of ether and air, such as

is used for anæsthesia, is so rich that a comparatively large spark can be passed through it without causing ignition, but the same spark will readily ignite a mixture of the same proportions consisting of ether and oxygen.

The low ignition temperatures of ether and ether and oxygen mixtures must be borne in mind. Ether vapour ignites at the relatively low temperature of 190°C., and liquid ether, contaminated by impurities, may ignite at the temperature of boiling water.

Dr. Morgan showed by experiment that ether vapour could enter the exit tube of a Shipway's apparatus, if ether were in the ether bottle, even when, apparently, only chloroform vapour or air was being pumped out. Ether vapour entered the delivery tube either by diffusion or suction. The danger is accentuated when warm water is placed around the ether bottle.

Dr. Morgan showed a tap devised to overcome this risk, and also a pencil light, constructed by Messrs. Joseph Lucas, Ltd., to make sparking impossible.

Dr. C. H. Hadfield drew attention to the work of the late Professor H. B. Dixon, and to the increased danger if the explosive vapour was being given endo-tracheally. The use of the diathermy knife widened the range of danger.

Dr. Kirkby Thomas related an incident showing the low temperature at which ether would ignite.

Mr. V. G. Negus pointed out that if the suction pump was properly enclosed there should be no risk from this source.

Dr. Langton Hewer gave evidence of the little risk in intubating under ether anæsthesia. He alluded to the possible risks of using ether in a private room with an open fire.

Mr. G. Ramsey Phillips reported a case of combustion in a gas oxygen apparatus said to be due to sudden liberation of oxygen at high pressure (1750 lbs. per square inch). He also referred to the fact that sometimes ether is found in returned empty oxygen cylinders. To avoid the first risk the reducing valve must always be opened first and the bottle valve very gradually. To avoid the second the oxygen valve must be turned off directly the bottle is empty.

At the meeting on December 4th Sir Francis Shipway read a paper on "Resuscitation," of which we give a full résumé at page 69.

Many speakers took part in the discussion which followed.

Dame. L. McIlroy described the methods which she empolys for reviving the newly born when they need treatment. In most cases of blue asphyxia respiration becomes established, she said, as soon as the air passages are cleared of mucus. She employed a mucus catheter made from an ordinary rubber catheter and part of a

laboratory pipette. This is better than the metal instrument, as the rubber cannot damage the infant's mouth, and the glass bulb stems the passage of mucus before it reaches the operator's mouth. Insufflation was never employed owing to the risk of undue pressure, and also of sepsis from the breath. The tube for suction was inserted in the infant's mouth but could never be passed into the trachea. In the case of failure to establish respiration she applied a mixture of five per cent CO_2, by means of a mask attached to a pressure gauge water valve and cylinder. She had found difficulty in regulating the pressure, and had worked since 1926 with various kinds of apparatus devised in conjunction with Messrs. Siebe, Gorman and Co. The amount of pressure (eight inches of water) was most important and such a gauge should always be used. Various forms of the apparatus were now used in the Obstetrical Unit of the Royal Free Hospital and a portable one for the district patients. Asphyxia is in some instances caused by the first breath of the infant sucking in mucus or liquor amnii. A number of infants are born alive but require considerable effort in reviving owing to want of precaution in clearing the mouth. In her opinion an infant should be kept warm immediately after delivery. No bath should be given, but the babe should be cleansed with blue oil until separation of the cord has taken place. Artificial respiration, with the exception of gentle compression of the chest, or tongue traction, should be entirely superseded by the administration of CO_2 and oxygen. Intracranial injury is the most frequent cause of white asphyxia. No adult suffering from similar accidental injuries would be treated with baths or by any method but the most complete rest attainable.

Mr. H. H. Kensole described a case in which the heart's action ceased during induction of anæsthesia by chloroform and ether. By cardiac massage and administration of CO_2 and oxygen natural respiration had been maintained for two hours, and after a further two hours with artificial respiration the patient's pupils could be made to contract and the colour to return by recommencing the above measures after witholding them for 30 to 40 seconds at a time. In such circumstances when is an anæsthetist justified in giving up hope? When is death to be presumed present?

With regard to puncture of the auricle, if this acts by stimulation of the sino-auricular node or of the bundle of His, would not puncture of either auricle be equally efficacious?

Mr. R. J. Minnitt described the case of a youth in whom part of the thyroid, weighing one pound one ounce, had been removed and the endotracheal catheter withdrawn when cyanosis and expiratory dyspnœa became extreme. Pulling forward the tongue gave no relief. A mixture of five per cent CO_2 in oxygen was given at intervals of fifteen minutes for about an hour; the colour and breathing markedly improving after each administration. When

consciousness returned there was no further trouble. Mr. Minnitt attributed the symptoms to collapse of the trachea.

Mr. C. Langton Hewer said that probably the most efficient form of artificial respiration was to pass a large rubber intubation tube fitting the glottis, and to connect this with a bag and expiratory valve as in rebreathing intubation anæsthesia. The lungs could then be rhythmically inflated and deflated with CO_2 and oxygen mixture, the intra-pulmonary pressure being practically equal to that inside the bag.

Mr. I. W. Magill said definite establishment of a free air way appeared to be of first importance. This was best achieved by direct vision intubation, and a laryngoscope and catheter or rubber tube for this purpose should be at hand in every operating theatre. When intubation had been performed after respiratory arrest it was not enough simply to blow oxygen into the trachea. Using low pressure the normal rhythm of respiration should be imitated. During the inspiratory phase the outlet should be obstructed by holding the nose and covering the mouth, thereby causing inflation of the lungs. During the expiratory phase the obstruction should be released and the ribs compressed. Continuous high pressure was unlikely to assist pulmonary circulation. He referred to an apparatus which carried out artificial respiration automatically. The negative pressure phase was held to be particularly important in assisting pulmonary circulation. In emergencies CO_2 could be obtained by inverting an ordinary domestic soda-water syphon when full and pressing on the stopcock.

REVIEW.

On the conservation of the lymphoid tissue of the upper respiratory tract, by T. LAYTON, Ash and Co., pp. 46, price 1/-.

THE main portion of this little book, admirable and original as are its exposition and its views contains nothing of particular interest for the anæsthetist. Certain pages, however, concern him very directly and on their account, presumably, the book reached us for review. Dr. Layton holds strong views about the risks of anæsthesia in operations for tonsils and adenoids, and his views are both well expressed and logically maintained. With regard to anæsthetic fatalities generally he states that "the increase of deaths under anæsthesia during the past twelve years is to my mind the most important surgical problem of the day." He discountenances the idea that the increase of deaths is merely the normal accompaniment of a corresponding increase in the number of operations, for these have surely not multiplied by two and a half in eleven years. Dr. Layton's views on anæsthetics deserve the serious attention of all anæsthetists, not the less so because he does not put the responsibility on to them, but regards the first liability as that of the surgeon.